REPORT

ON THE

ARBORICULTURAL OPERATIONS

IN THE

NORTH-WESTERN PROVINCES AND OUDH,

DURING THE YEAR ENDING 31ST MARCH, 1880.

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No. $\frac{T}{476A.}$ OF 1880.

FROM

THE DIRECTOR, DEPARTMENT OF AGRI. AND COMMERCE,
N.-W. PROVINCES AND OUDH,

TO

THE SECRETARY TO GOVERNMENT,
N.-W. PROVINCES AND OUDH.

Dated Naini Tal, the 30th August, 1880.

SIR,

I HAVE the honor to report on the arboricultural operations in these provinces during the year 1879-80.

2. *Preliminary remarks.*—As this is the first report submitted by this department on the subject, it may be advisable to recapitulate the circumstances under which the arboricultural work was transferred to it from that of the Public Works, and the preliminary measures taken to put the operations on a satisfactory footing.

3. *Grounds for transfer.*—On 31st July, 1877, Mr. Buck asked the Government, in the Public Works Department, to allow him to undertake the administrative control of district arboriculture for the following reasons :—

(1.) The nurseries at the different gardens were under his control, from which supplies of seeds and plants could be arranged and new and useful trees introduced.

(2.) He could superintend the system of thinning out of roadside trees, by which a fund could be created to meet a considerable portion of the expenditure.

(3.) He could exercise continuous supervision, so that the work of one officer who might take an interest in the subject might not be thrown away by the neglect of his successors.

(4.) Arboriculture, being one of the most important elements in the agricultural stability of the country from the fact that trees counteract the fearful aridity of the climate in the hot months and supply vegetable manure from their decayed leaves, is intimately connected with the work of the Agricultural Department.

(5.) It is also therefore a duty of this department to increase by a proper selection of trees the food supply of the people and of cattle.

4. *Mr. Buck's programme.*—Shortly after Mr. Buck submitted a detailed note giving a programme of operations he had in contemplation. The chief features of the plan sketched in this note were—

(1.) Formation of central nurseries in different parts of the province in which trees suitable to the climate and soil might be reared.

(2.) Discouragement to the establishment of small nurseries in several parts of a district without some guarantee of their being properly taken care of.

(3) Thinning out existing avenues which are in a very neglected condition.

(4.) Planting out new avenues only with fruit or fodder producing trees.

(5.) Formation of plantations near large villages and towns of fruit trees of a superior class.

(6.) Plantations on waste lands.

5. Government generally approved these proposals, and the planting of new avenues, called "arboriculture," in the Public Works Department, as distinguished from "maintenance of avenues," was placed under the control of this department from the financial year 1878-79, with a grant of Rs 17,300 for the 47 districts of North-Western Provinces and Oudh. The Public Works Department retained the "maintenance of avenues" in their own hand.

6. *Operations in* 1878-79.—Little, however, could be done that year beyond giving instructions to the district officers as to carrying on the arboriculture operations under the new system The advisability of planting only fruit and fodder trees was also pointed out to them, and arrangements made for the supply of seeds and plants of such trees from the central nurseries.

7. *First difficulties.*—But in working the system difficulty was experienced in distinguishing the work under "arboriculture" or new avenues, belonging to this department, from "maintenance" of old avenues, belonging to the officers of the Public Works Department. The question was raised as to the length of time after which an avenue ceased to be called a new avenue, and whether planting a length of road in the midst of an old avenue was a new avenue or not? To avoid these complications the Public Works Department made over to this office the whole arboricultural work both of new and old avenues. At the same time a grant of Rs. 35,000 was placed at the disposal of this department. This arrangement came into force from the financial year 1879-80, the year under report. For a certain part of the year the accounts remained in the hands of the Public Works Department, but they have since been transferred to the civil treasuries under the audit of the Accountant-General.

8. *Instructions to district officers.*—Full instructions were issued during the year to district officers in charge of arboriculture operations on the following points:—

(1.) Raising plants in nurseries.
(2.) Planting out.
(3.) Protection from cattle, &c.
(4.) Watering.
(5.) Lopping and fellings.
(6.) Kinds of trees to be planted.

These instructions embodied the experience gained by the officers of this department from experiments in public gardens as well as the experience acquired by the officers of the Forest Department in their professional capacity. They are given in the circular printed in appendix I. to this report, which brings together for handy reference the general principles suggested in previous circulars.

9. *Trees allowed.*—The following trees were recommended for planting:—

Feronia elephantum	...	...	...	Vernacular	Kathal
Ægle marmelos	...	...	...	"	Bel
Zizyphus jujuba	...	...	..	"	Ber
Mangifera indica	...	...	...	"	Am
Buchanania latifolia	...	...	...	"	Piar or chironji.
Moringa pterygosperma	...	...	...	"	Sajna.
Tamarindus indica	...	...	...	"	Imli
Ceratonia siliqua	...	...	...	"	Carob.
Prosopis spicigera	...	...	..	"	Jand.
Inga dulcis	...	...	...	"	Dakhni babul.
Acacia arabica	...	...	...	"	Babul.
Terminalia bellerica	...	...	...	"	Bahera.
" chebula	...	...	...	"	Harra.
" tomentosa	...	...	...	"	Assair

Eugenia jambolana	Vernacular	Jamun.
Bassia latifolia	"	Mahua.
Mimusops indica	"	Khirni.
elengis	"	Munisari.
Diospyros melanoxylon	"	Tendu.
Cordia myxa	"	Lasora.
Morus alba et nigra	"	Fut.
Ficus indica	"	Bargad.
" religiosa	"	Pipal.
" infectoria	"	Pakar.
" cordifolia	"	Kabar.
" glomerata	"	Gular.
Artocarpus integrifolia	"	Kathar.
" lakucha	"	Barhal.

The planting of the nim and sissu trees have been allowed in particular cases. The planting of purely ornamental trees, such as the kachnar, the siris, &c., has been forbidden.

10 After these preliminary remarks I proceed to give a general description of the arboricultural operations during the financial year 1879-80, the year under report.

11. *Length taken in* 1879-80.—The total length of the roads in the 47 districts of North-Western Provinces and Oudh was 23,145 miles, of which 1,430 miles were under operation during 1879-80.

These are shown as follows, division by division :—

Division.	Total length.	Under operation.
	Miles.	Miles.
Meerut	2,676	129½
Rohilkhand	2,045	94
Agra	2,540½	47½
Allahabad	3,231	554½
Jhánsi	1,057	176½
Benares	4,870	66½
Kumaun	2 397	8
Lucknow	1,233	...
Fyzabad	1,029	180
Sitapur	993	50½
Rae Bareli	1,074	123
Total	*23,145	† 1,430

12. *Plants in nurseries.*—One hundred and ten nurseries supply these roads with plants, besides the central nurseries at Saháranpur, Cawnpore, and Lucknow. At the beginning of the year these nurseries (as reported by district officers) contained 86,726 seedlings. 219,561 seedlings were planted during the year in the nurseries and 31,970 plants were transplanted on to the roads, leaving at the end of the year 263,162 seedlings in the nurseries for use in future years.

The following statement shows these figures, division by division :—

Division.	Number of seedlings at the beginning of the year.	Number planted during the year.	Number transplanted.	Number at the end of the year.
Meerut	8,207	12,698	2,324	25,313
Rohilkhand	6,316	18,853	2,349	28,895
Agra	15,110	9,286	1,096	20,008
Allahabad	11,273	33,201	15,534	27,352
Jhánsi	12,018	11 095	466	8,793
Benares	4,663	26,001	2,274	28,961
Kumaun	10.732	457	1,612	10,897
Lucknow	3,165	79,595	744	77,986
Fyzabad	4,885	2,402	1,189	6,650
Sitapur	1,614	4,194	490	5,130
Rae Bareli	8,843	21,781	3.392	23,177
Total	86,726	219,561	31,970	263,162

*Does not include Etáwah, Fyzabad, Sháhjahánpur, and Sitapur, from which figures were not obtained.

†With the exception of Etáwah, Hamírpur, Bara Banki, and Unao, from which no figures have been sent up.

13. As I have observed above, no trees other than those producing food for man or cattle are allowed to be raised in the nurseries or transplanted on the roads, and the number of seedlings remaining at the nurseries at the end of the year, therefore, include a very large number of fruit or fodder trees.

The following statement shows the number of the principal kinds :—

Name of tree.	Transplanted on roads during 1879-80.	*Remaining in the nurseries at the end of 1879-80.
Mango	11,610	95,176
Jaman	9,965	57,933
Mahua	2,419	14,813
Gular	729	12,554
Pipal and pakur	1,013	8,763
Babul	3,375	239
Tamarind	499	7,421
Lasora	77	1,996
Jack	73	21,000
Nim and bakain	2,389	4,278
Other fruit or fodder trees	2,647	16,858
Trees not producing fruit or fodder	12,170	16,833
Total	46,926	257,864
Number of trees for which no details received	4,915	5,398
Total	† 51,841	263,262

The trees shown above as transplanted were put on 479½ miles of roads in the several districts.

14. In accordance with Mr. Buck's programme four central nurseries have already been formed at Saháranpur, Cawnpore, Lucknow, and Gorakhpur. The Lucknow one is by far the most important; new land has been taken up and a large number of seedlings put in under Mr. Ridley's supervision. The number remaining at the nursery at the end of 1879-80 is returned as follows :—

Eucalyptus resinifera	250
,, rostrata	770
Jack fruit	406
Tamarind	5,800
Pakar	400
Mahua	5,300
Pipal	5,300
Bahera	190
Gular	6,500
Jaman	13,275
Mango	27,750
Total ...	65,941

The Gorakhpur central nursery has upwards of 22,000 plants in stock. The expense of carriage, however, from central nurseries (especially of three-year old trees as recommended by Mr. Buck) has proved so great that subsidiary nurseries have in many places been established near the field of operations. In addition to economy the maintenance of these nurseries, according to my experience, frequently gives the officer in charge of any given portion of a road under treatment a special interest in the work entrusted to him.

* Includes plants remaining in the nurseries at the end of 1879-80 in the several districts of the North-Western Provinces and Oudh, with the exception of Saháranpur, Farukhabad, Etáwah, Jhánsi, Allahabad, Mirzapur, and Gonda, from which no details received.

† The figures given in these returns are those sent up from the district officers. I did not consider it worth while delaying the report whilst the discrepancies were being explained.

15. *Planting*, 1879-80.—The planting of trees on roadsides was carried on in almost all districts, except where the seedlings in the nursery were too small to allow of their being transplanted. A larger grant was allowed for this purpose to districts south of the Jumna, where trees are very scarce. In the Bánda district alone 14,131 trees were put down on roads last year, of which 6,620 were jaman, 2,671 mango, and 1,410 mahua. In the hill districts, where trees from the plains will not grow, plants suited to the climate are being raised in the nurseries and planted on roads. In the Kumaun nurseries there are 3,000 cherries, 400 chestnuts, and 4,200 tallow trees, besides a large number of others of less usefulness. Last year 220 chestnuts, 25 cherries, and 525 tallow trees were planted out, as well as about 200 of other varieties. The Garhwál nurseries are chiefly used for the distribution of useful fruit trees to the villagers, quite a legitimate object under arboriculture.

16. *Formation of groves.*—Groves have also been planted here and there. The establishment of two have been reported to this office,—one at Bulandshahr and the other at Gorakhpur. Instructions were given for their establishment on an extensive scale in the Jhánsi division, but no report has yet been received on the progress made in this direction.

17. *Planting by private persons*.—Attempts are now being made in several districts to induce the zemindars and cultivators to plant trees on condition of their being allowed to use the fruit and dead wood. It is well known that Hindus consider the work of affording shade to wayworn passengers an act of great piety. On this consideration a few miles of the Basti-Jaunpur road have been planted by a rich merchant with the hope of being blessed with a son in return for this good deed. This system has worked very well in the Gonda district, where "the cultivators and pattidars came forward eagerly to obtain permission to plant, and so complete was the success of the scheme that on examining the state of the trees and thalas it was found that far more had been planted than could be paid for out of the year's grant. The talukdars who planted do not require any payment." The Deputy Commissioner of Rae Bareli also hopes that the scheme will succeed in his district. He writes :—"In this district the poorness of a great deal of the soil and the great prevalence of white-ants make the maintenance of avenues somewhat difficult, but from the excellent spirit which prevails among the talukdars and zemindars it is hoped that success will be achieved in the course now being entered on of getting gaps filled and avenues planted by the owners instead of by Government." In Muttra too, the trees on the greater part of the Muttra-Dig road were planted by private persons who look after them and take the fruit and dead wood. Last year the Collector directed them to fill up the gaps, in which direction they did something, but not in a satisfactory manner. In the Cawnpore district the zemindars have planted 4,847 trees. In Bareilly Lala Damodar Das has earned the special thanks of the Collector for his liberality in the direction of tree-planting; and in Mr. Reid's opinion deserves the approval of Government for his generous action. Considering the small amount of money that can be allotted to each district from the Government grant, this system will prove a great boon to the arboriculture cause if it can be extensively introduced into other districts. Constant efforts will be made in this direction.

18. *Expenditure in* 1879-80.—As stated before, the grant placed at the disposal of this department for arboriculture purposes was Rs. 35,000. This amount was distributed according to the requirements of each tract of the provinces, the well-wooded districts along the Himalayas receiving less than the bare tracts forming the southern portion of the province. A normal grant of Rs. 250 is in the first instance allowed to each district, which is increased or decreased on receipt of explanations regarding their special requirements. The following statement shows the grant and expenditure in each division during the past year. The total expenditure was Rs. 27,604-11-1; the savings, Rs. 4,356-4-11, lapsed to Government :—

Division.	Grant.			Expenditure.			Savings.		
	Rs	a.	p	Rs.	a.	p.	Rs.	a	p
Meerut	4,050	0	0	3,291	15	6	758	0	11
Rohilkhand	4,090	0	0	3,282	3	0	707	13	0
Agra	4,186	0	0	3,966	13	5	219	2	7
Jhánsi	3,150	0	0	2,717	7	10	* 432	8	2
Allahabad	5,980	0	0	4,558	5	0	1,421	11	0
Benares	4 150	0	0	3,047	2	0	1,102	14	0
Kumaun	280	0	0	251	11	10	28	4	2
Lucknow	2,900	0	0	2,833	14	8	66	1	4
Fyzabad	875	0	0	868	2	9	6	13	3
Sitapur	850	0	0	1,323	4	2	—473	4	2
Rae Barch	1,650	0	0	1,563	11	4	86	4	8
Total ...	32,161	0	0	27,804	11	1	4,356	4	11

The savings lapsed owing to the new system not being in full working order, not because the full amount was not required. On the contrary, the grant is quite insufficient for the requirements of the 47 districts among which it is distributed, and many applications for further grants from officers who may be trusted to see they are well spent have to be refused.

19. *Lopping and felling.*—Under this head Mr. Buck originally proposed to form a new fund, to be called the Avenue Fund, from which he proposed to allot 50 per cent. of the receipts to each district, with the object of increasing their available funds for this important work. It was, however, ruled that the formation of a new fund was against the rules, &c., &c. Government have recently sanctioned my proposal that a grant shall be made each year equal to the net receipts under this head of the previous year. This sum will be allotted similarly to the original grant, except that each district will have a preferential claim on at least 50 per cent. of its own receipts.

20. *Distribution of mango grafts.*—Connected with arboriculture the work of extending better varieties of the indigenous fruit trees has also been taken in hand by this department. The superintendents of the various gardens have had their attention called to the importance of improving the quality of indigenous fruits and propagating superior species for distribution. Much attention has been paid to the mango, being the best and most common fruit in India, and arrangements have been made for the distribution among zemindars and cultivators of grafts of the best kinds at a very low rate. The system of inarching with small seedlings of the same year, brought to the notice of this department by Mr. Phillips, will, it is expected, prove of great service, as it reduces the cost of grafting and, on account of their lightness, the freight in sending the grafts out. The selling price of each graft was formerly eight annas to a rupee, now it has been reduced to two annas apiece. The net cost of each graft on this system is only half an anna. Difficulty, however, was experienced in obtaining a large number of grafts for want of sufficient mature trees for inarching. The Canal Department was requested to allow their plantations in the Saháranpur district to be utilised for the purpose, and arrangements have been made for obtaining grafts in 1880-81. During the same year 5,000 grafts will also be purchased from the Khushru Bagh at two annas each, and about 2,000 more will be raised at the Cawnpore Farm garden. All these grafts will be offered to the public at two annas each, exclusive of freight, and they consist principally of the three varieties, the Maldah, Bombay, and Lengra. Another variety, the Fazli, considered to be the best in Bengal, will also shortly be imported. The district officers have also been asked to set aside a portion of every nursery established for permanent maintenance, which should ordinarily be planted with mangoes of the best kinds, in order to establish a stock of mature trees from which to raise grafts in future years for distribution. But for purposes of Government arboriculture the planting of grafted mangoes will probably have to be

* In the Panjáb I gather from the reports the grant is over Rs. 75,000.

limited to village groves or minor roads, for on account of their shrubby nature they afford insufficient shade on first class roads.

21. The following papers are sent as appendices to this report:—

I. Instructions to district officers on growing trees for roadside avenues.

II. Statement showing general state of arboriculture in each district and programme of future operations.

22. To sum up the general results of arboriculture during 1879-80, I may say that the state of transition in the arrangements was prejudicial to success. Contradictory orders were apparently passed, and the rainy season was over before full effect could be given to Mr. Buck's proposals. They are now, however, more generally understood, and I believe I may say with confidence are being carried out in a large number of instances thoroughly and loyally. The benefits of bringing all arboricultural operations under one systematic review are already apparent. The experience gained in one district can be communicated to another; the greater interest shown by one officer than by another can be taken advantage of to push arboriculture in the district under his control. The haphazard way in which the planting was carried out in many districts under the subordinate officers of the Public Works Department comes out very clearly in district reports, and I advise the whole arboricultural operations of a district being placed in charge of an Assistant Collector (as nearly every special branch of administration is now). I can testify to excellent results already obtained where this has been done.

23. It is only fair to the officers concerned to place on record that Mr. Reid, Collector of Bareilly; Mr. McConaghey; Collector of Bánda; Mr. Boys, Deputy Commissioner of Gonda; and Mr. A. H. Harington, Deputy Commissioner of Rào Bareli, have given a great deal of personal attention to this interesting subject, and that this direct supervision cannot but produce the most beneficial results in district arboriculture.

I have the honor to be

SIR,

Your most obedient servant,

F. N. WRIGHT,

Offg. Director, Dept. of Agri. and Commerce,
N.-W. Provinces and Oudh.

APPENDIX I.

I.—RAISING PLANTS IN NURSERIES.

THE plot of ground chosen for a nursery should be as near as possible to the length of road on which planting is to be commenced, so as to save the expense of carriage and to diminish the risk in transplanting the seedlings to the place they are to occupy. Raising plants in nurseries.

2. If the ground is irrigable and no expenditure is required for well-sinking, &c., starting a new nursery involves but little extra cost beyond that of keeping up an old one, and it is therefore recommended that the nursery be shifted with each change of the locality on which planting is undertaken.

3. In selecting a plot of ground for a nursery, the first point to look to is *irrigation*, and the wells which have been constructed at intervals along the sides of the most of the chief roads offer admirable facilities for this. If canal-water can be made available, its cheapness is greatly in its favor. Without irrigation the maintenance of a nursery is well nigh impossible. Irrigation.

4. An east aspect is the most favourable one, and a portion of the area should be shaded by trees. Shade is essential to the successful rearing of very many trees from seed or cuttings, and is beneficial in almost every case during the first year. A light soil is to be preferred to a heavy one, since cuttings strike best in it, but the soil should not be too sandy, or it will be difficult to get balls of earth to adhere to the roots of plants in transplanting. The ground should be well dug up to the depth of one foot, and manure in the form of leaf-mould added plentifully. If pits are filled with leaves during the months of leaf-fall (March and April), and left open till the rains commence, the leaves will quickly rot and form admirable manure by the year succeeding. Shade. Soil. Manure.

5. The ground should be marked out into beds lying in the direction of the drainage flow ; a convenient width is six feet. Each bed should be separated from the one next to it by a small bank about one foot in width. Or the plan may be tried of growing plants on ridges, the ground being thrown up into parallel ridges, six inches high and nine inches wide, with furrows of corresponding size alternating with them. This can very easily be done with a light American plough (such as the one issued by this Department) and a pair of good bullocks. The seeds are sown on the ridges, while the water is allowed to run into the furrows, and the advantage of this system is that it renders irrigation possible without the subsequent caking of the surface crust which is so prejudicial to young plants. Weeding is also facilitated. Should irrigation be conducted by surface-flooding, the soil must always be broken up with the *khurpa* afterwards. The need of irrigation is much diminished, if, as recommended above, all the seedling beds are in shade. Seed-beds.

6. The seeds should always be sown in lines 3½ inches apart, by which weeding is much facilitated. The time at which seed should be sown may be generally stated to be the season in which it ripens and sows itself naturally by falling from the trees. Dry seeds, such as those of the *Babul*, &c., may, however, be kept for three or four months after ripening, *e. g.*, from March till the commencement of the rains, but fleshy seeds (*e. g.*, *jamun* and *mahua*) must be sown immediately they are ripe. The period of seed ripening for each tree, the propagation of which is recommended, is shown in column 3 of the appended table. Sowing.

7. In the case of some trees, chiefly those of the Fig order *(pipal, bargad*, &c.), propagation by cuttings is recommended instead of by seed, since their seed is made to germinate with great difficulty. Indeed, it is popularly supposed that the seeds of the *bargad* will only germinate after having been eaten and voided by birds. Propagation by cuttings.

Cuttings of these trees, on the other hand, throw out roots and grow with great rapidity, though there may be some reason for doubting whether the tree which results will be as strong and well-grown as one from a seedling

Method of making and putting down cuttings.

8. In putting down cuttings, twigs a year old should be selected and cut from the tree before it begins to put forth its spring shoots, *i.e.*, from December to February, or (in the case of trees of the Fig order) at the commencement of the rains. The pieces should be 1½ to 2 feet long, and should be placed standing in loose moist soil buried to half their length. It is absolutely necessary for success that the twig should possess *two uninjured buds*, one below ground and one above. Before planting, it may be well to immerse the cuttings in water for a few days.

Shifting seedlings.

9. From four to eight months after the date of sowing it becomes necessary to thin out the seedlings and shift them to the planting-out beds. These should not be in premanent shade, though it may be necessary to give some protection from the rays of the sun (by *chappars*, &c.) during the months of extreme heat, especially during the first few months after transplanting. As a rule, plants sown in March or April will be ready to be shifted by the commencement of the following rains, or if sown in the rains, by the February or March following. The seedlings should be planted at intervals of from 1½ to 2 feet apart. Irrigation will be much saved if the plants be *mulched* or watered by *gharas*, as is described in paras. 13 and 14. It will be noticed in the table which follows these instructions that, in the case of certain trees, sowing *in situ* is recommended. . In this case the seeds should always be sown round a *ghara* buried in the ground and kept filled with water (see para. 15).

II.—PLANTING OUT.

Planting out

10. Seedlings are ready for transplanting to the place they are to occupy permanently by the end of the third year. Planting out earlier than this is to be discouraged, since the seedlings require far more water and attention when quite young than when they have attained a certain degree of maturity. The holes for the reception of the young trees should be 3 feet deep, 4 feet wide at the top, and 3 feet wide at the bottom. This gives 27·5 cubic feet of earthwork for each hole. They should invariably be dug during the cold weather preceding the rains in which planting out is commenced, and the earth should be left to lie exposed to the sun and air during a hot weather season. In March or April each hole should be half filled with dry leaves which will become saturated on the first fall of rain. In planting, the leaves should be drawn away from the middle and the bottom of the hole, so as to leave a clear space 3 feet deep by 2 feet in diameter, which should be filled in with earth, in the centre of which the roots of the tree should be planted.

Transplanting with earth

11. When possible a ball of earth should be taken up round the roots of young trees in transplanting them, since, by doing this, the risk of moving is reduced to a minimum: when the nursery is near the locality in which the planting is in progress this may very easily be done, though, of course, it will add a great deal to cost of carriage should it be necessary to send the plants any distance. It is well to keep the plants without water for from ten days or a fortnight before moving them, since this will check the formation of tender shoots and thereby lessen the risk. But water should be given the day before moving, since this will greatly facilitate taking up balls of earth with the roots. If the plants have to be carried any distance, their roots may be dipped in a compost of cowdung and water of the consistence of cream as soon as they are taken from the ground. In any case, transplanting should only be conducted during rainy or cloudy weather, or in the evening after four o'clock.

Transplanting without earth

12. Should it be found impossible to remove earth with the roots of the young tree, great care must be taken in planting it to keep the roots in the same position as they were in before removal. The tree should be held by one hand upright in the hole, while with the other hand sifted earth is sprinkled around and between the rootlets; the earth should be well pressed down when the roots are covered.

III.—PROTECTION.

Protection.

The different methods in use.

13. Many and various are the different means which have been recommended or adopted for protecting young trees from the attacks of cattle. The great objection to the mud wall "*thaunla*," which is most commonly used, is its expense, since it costs six annas to build up and requires constant repair. A thick overhanging fence of thorns, or cactus, &c., is also to be objected to, since it tends to choke the young tree and interfere with its growth. A deep circular ditch, if *dug too close to the roots of the tree*, is most pernicious, since it virtually leaves the young tree perched on a cone of earth, baked on all sides by the sun during the hot weather, and drenched in the rains by the water which fills the ditch. The cheapest and most effective method of protection possible appears to be that recommended by the Conservator of Forests, Central Circle. As has been described in Part II., the hole in which the young tree is planted should be 3 feet deep and 4 feet in diameter at the top and 3 feet at the bottom. Taking the middle of this hole as a centre, draw two circles round it, one of 4 feet radius and the other of 6 feet, outside the hole; there will thus be two circles, one of 8 feet and the other of 12 feet diameter. Dig out the earth from the space between the circumferences of the outer and inner circles, and throw it up on the space between the circumference of the inner circle, and the edge of the plant hole, so as to make a trench 2½ feet deep 2 feet broad at the top and 1 foot broad at the bottom, with a sloping mud bank inside it 2 feet broad and 2½ feet high. Inside the mud wall will be the plant hole. The ditch will thus be at least 3 feet distant from the roots of the young tree. Some Babul thorns should be stuck into the top of the bank while the earth is wet. The cost of the plant hole and protecting bank and ditch will not be more than—

The method now recommended

Plant-hole $=(3\frac{1}{2}')^2 \times \cdot 75 \times 3' = 27\cdot 5$ cubic feet

Ditch and bank $=(11')\times \cdot 75 \times 2\frac{1}{2}' = 226\cdot 875$ *minus* $(9')\times \cdot 75 \times 2\frac{1}{2} = 151\cdot 875 = 75\cdot 0$ cubic feet.

Total 102·5 cubic feet, which, at Rs. 1-4-0 per thousand, will cost a fraction over two annas.

14. The bank and ditch should be made during the rains, after the tree has been planted. It will require but little repair, and as soon as the tree is old enough to dispense with it, the bank can easily be thrown back again into the ditch and the ground neatly levelled. Before filling in the ditch it will be as well to take the opportunity of "*mulching*" the tree roots by half filling the ditch with dead leaves and saturating them with water. This will tend to draw out the roots and give the tree increased power of resisting drought.

IV.—IRRIGATION.

15. A young tree two or three years old may be presumed to require watering for three years after it has been planted out. Irrigation forms so large an item in arboricultural expenditure that a system through which any diminution in its cost can be effected will greatly facilitate the extension of tree-planting. What may be termed the "*ghara*" system of watering appears to promise cheaper irrigation than that generally resorted to, and reference is made to this Office Circular No. 2Arb., dated 26th February, 1880, enclosing a note by Captain Hall, R. E., in which a comparison is made of the relative cost of watering trees on canal banks by *gharas* buried near their roots, and by the ordinary system of surface irrigation. The method followed was burying an ordinary *ghara* of porous earthenware, close to the roots of the young tree, with its neck on a level with the surface of the ground. The *ghara* was kept full of water, which reaches the roots of the tree by percolation through the pores of the earthenware, so that no surface irrigation is required at all. By this means no water is ever poured over the soil round the roots, and, in consequence, the hard crust is not formed which is so prejudicial to the health of young growing plants. The soil-surface continues loose and open, and water is supplied to the roots direct. *Cheapness* and *certainty* are other important advantages of the system. As regards the cheapness, Captain Hall's calculations cannot be held to apply to ordinary roadside arboriculture,

The *ghara* system.

Its advantages.

It supplies water directly to the roots

Its cheapness.

which frequently involves carriage of the water required to fill the *gharas* from a long distance, while on a canal bank water is available close at hand. At the same time the cheapness of the system may be judged of from the following facts :—

Gharas should not cost more than Rs. 2-4-0 per 100 delivered on the spot.

A *ghara* loses its water (by percolation and evaporation) in two weeks during the hot season (March—June), and in four weeks during the cold season, though probably it would be advisable to refill it every ten and twenty days respectively.

An ordinary *bhisti's massak* contains 4½ *gharas* of water.

Therefore, if a bhisti can deliver so small a number as eight massaks per diem, he will be able to irrigate 720 trees in the cold weather and 360 trees in the hot, the average for eight months of the year being 540.

The cost of irrigating 540 trees for one year will be (assuming that the *gharas* will last two years) —

	Rs.	a.	p.
Cost of *gharas* $\frac{\text{Rs } 2\text{-}4\text{-}0}{2}$	1	2	0
Pay of a bhisti for eight months (@ Rs. 5)	10	0	0
Total ...	11	2	0

or 1 anna 3 pie per tree.

The certainty which it gives.

The greater *certainty* of the system consists in the fact that under it, it is particularly easy to check by inspection the way in which the watering is being conducted, and to ensure, therefore, that the plants are fed with a proper supply.

16. It is very desirable that the system be given a careful trial, with the object of discovering whether, as a matter of fact, it can be worked as cheaply as appears to be the case, and whether it has any counterbalancing disadvantages which have not as yet been detected. Watering by *gharas* has for years been a common practice in private gardens, but appears not to have been tried on a large scale in roadside arboriculture.

V.—LOPPING AND FELLING.

Lopping

17. Lopping may be required in order to train a tree into proper shape—in order to remove branches which, hanging too close to the thoroughfare, interfere with traffic, —or in order to prevent one tree from encroaching on another and checking its growth. In any case it is important that as little mutilation be effected as possible, since the severance of large or important limbs is apt to cause much injury to a tree, and the large wounds which result are liable to become centres of disease from which rot may spread through the whole trunk. So far as *pruning* is concerned, the less done the better, and, if at all, it should be done while the tree is quite young, when its growth can be guided by the removal of small branches and twigs. Lopping to prevent encroachment on neighbouring trees is only necessary when either the trees have been planted too close to one another, or when different kinds of trees have been planted in juxtaposition, *having a different rate of growth among themselves.* This, of course, is always to be avoided, and it is for this reason that mixed avenues are not as a rule to be recommended. In every case where lopping is necessary the branch should be cut or sawn off *flush* with the trunk of the tree, or with the main branch from which it springs, and the surface of the wound should, if possible, be smeared with a coating of coal tar or resin to keep out wet and prevent decay. In no case should a stump be left, as is very generally done; for although, when a branch is cut off *flush* with the trunk, a larger wound may result than if it were cut off a foot or so from its insertion, yet the wound is in the direct line of the descending sap, and fresh layers of wood will, in consequence, be deposited on it, which is not the case when a stump is left. The decay of a stump which has remained unhealed is a frequent cause of hollowness in a tree. The best instrument for lopping in unpractised hands is a hand-saw, the use of which has been recommended in this Office Circular No. 4Arb., dated 26th May, 1880. The ordinary iron country hatchet is the worst possible instrument for the purpose, since the wounds it leaves are invariably rough and jagged.

Proper method of lopping

18. The season for lopping is either the end of the cold weather (February) or the end of the rains (September). If it be done in February, the wounds will heal quicker ; but " if the lopping takes place at the end of the summer, before the annual growth has quite finished, we deprive the tree of nourishing sap, and a smaller number of new shoots will form round the wounds" (*Ribbentrop's Panjab Arboriculture.*) Season for lopping.

19. In *felling* a tree the earth should, first of all, be grubbed away, so as to leave the upper roots exposed, and the trunk cut through a point about 1½ or 2 feet below the surface of the ground. This is the method ordinarily followed by natives, and not only does it add to the length of the timber, but it prevents, in the case of most trees, the growth of suckers from the stock. Felling.

Attention is also invited to Arboricultural Circular No. 7, dated the 25th November, 1879.

APPENDIX II.

Name Botanical, English, and Vernacular	Description of tree and it uses.	Mode of propagation and season for procuring seed or making cuttings.	To be sown in nurseries or *in situ*, and any special instructions necessary.	Season for planting out.	Distance at which should be planted apart.	Natural habitat and any peculiarities of growth, &c.
Feronia elephantum Woodapple, *Kát bel.*	An elegant tree, moderate sized, with subdivided (pinnate) leaves and branchlets armed with thorns; bears, during the cold weather months, large globular fruit with a hard grey rind, containing an acid pulp, which is used for making jellies, pickles, &c.	By seed; fruit ripens in October; should be sown in April.	In nurseries ...	Rains ...	40	The forests of the outer Himalaya and Siwalik range; grows well in Bundelkhand and cultivated throughout the province.
Ægle marmelos, *Bel* ...	A small tree with bark of a bluish grey colour and leaves in 3 subdivisions; armed with straight sharp spines; fruit globular or oblong, ripening in April, with a smooth yellow rind, and containing a thick sweet pulp, which is used medicinally for dysentery and eaten as a preserve. Leaves and twigs are used as cattle-fodder.	By seed; fruit ripens and falls in April and May.	Ditto	Ditto ...	30'	The forests of the outer Himalaya and Siwalik range; cultivated all over the province.
Meli indica; *Nim* ...	A large tree; bark grey with numerous dark longitudinal and oblique wrinkled furrows; leaves subdivided, unequal sided; flowers small, white, with a strong smell of honey; fruit contains an acrid bitter oil, which is used medicinally; it is often eaten in times of scarcity.	By seed; fruit ripens in July and August.	In nurseries or *in situ*; four or five seeds being sown and the strongest seedling alone allowed to remain.	Cold weather or rains.	40'	Common throughout India, and will grow where no other tree except the *pipal* will.
Zizyphus jujuba, *Ber*,	A moderate sized tree, 30 to 50 with numerous spreading branches forming a round head; branches and branchlets generally armed with short spines generally in pairs, one straight and the other bent. Fruit yellow, plumshaped, with a sweetish pulp. It is much eaten by natives, and superior varieties have been produced by careful cultivation and grafting. The leaves are valued for cattle fodder.	By seed; the better class varieties are produced by grafting on seedling stocks; fruit ripens in March.	In nurseries; the seed should be sown 2" deep in loose soil; if sown shallow they are often scratched up by jackals.	Rains or January-February.	15' ultimately 30' by the removal of the alternate trees, which need not, of course, be of the same kind.	Wild in the Siwalik forests, but cultivated throughout India. Young trees can stand a good deal of drought, and will grow on soil too saline for Shisham It thrives best on sandy loam and ploughed land.
Mangifera indica, *Am*,	A large evergreen tree, 60 to 70'; leaves dark green, margin often waved; flowers small, yellow, sweet-scented. Cultivated mainly on account of its fruit.	By seed; in these provinces the better class of fruiters are produced by grafting.	In nurseries or *in situ*; four or five seeds being sown together and the healthiest seedling selected.	Rains ...	40'	Indigenous in Burma, where good varieties are grown from seed and not propagated by grafting. It is uncertain how far grafting is necessary in these provinces, and whether trees grown from good seeds might not equal the parent tree.
Buchanania latifolia, *Piar* or *Chironji*.	A moderate sized tree, 40 to 50' high, with a straight trunk; bark rough, tesselated into small quadrangular plates, divided by deep narrow furrows; leaves and young shoots covered with long silky hairs; flowers small, green; bears a black plumshaped fruit, the kernel of which is used largely in the manufacture of sweetmeats and yields an oil. The soft portion of the fruit has a pleasant sub-acid flavor and is much eaten in the Central Provinces.	By seed; which ripens in April-May.	In nurseries ..	Ditto ...	40'	A common tree in the dry forests of the Central India and the Bundelkhand hills. Will do well on a dry soil and succeeds best south of the Jumna.

Moringa pterygosperma, Horse radish tree, *Sajna.*	A small tree with subdivided light-green leaves and largish sweet-scented white flowers; bark light-coloured, corky, much cracked; fruit a long pendulous pod, which remains hanging on the tree a long time unless pulled; leaves used for fodder. Fruit, leaves, and flowers are eaten as vegetables and also preserved in pickles.	By seed; fruit ripens in April-May.	Ditto	Rains ...	30'	Commonly cultivated throughout India; wild in the forest of the outer Himalaya and Siwalik range. It is doubtful whether it is long-lived enough to make a good avenue tree, and is therefore not recommended.
Dalbergia sissu, *Shishám* or *Sissu.*	A large tree with light green delicate foliage and small yellowish white flowers; heart-wood dark brown. Is much used in cabinet-making, &c. Young leaves and twigs used as cattle fodder, and preferred by camels to *kikar.*	By seed in March or (very easily) by cuttings, which should be slips 1 foot long, put down in February.	In nurseries; grows readily from seed.	In January-February or in rains.	30'	Indigenous in the Sub-Himalayan forests. A light soil is essential to its success, and it flourishes luxuriantly on low-lying sandy alluvial tracts in the Panjáb. Is a handsome tree for avenues, but not to be preferred to the fig species.
Tamarindus indica, Tamarind, *Imli.*	A large tree often over 80 with subdivided (pinnate) leave, and yellowish flowers in loose clusters; trunk short and thick; crown magnificently broad and high; pods containing an acid pulp which is much preserved and is an invaluable antidote for scurvy. Extremely slow-growing.	By seed, which ripens in the cold weather, and should be sown in April.	In nurseries; the seedlings must be protected from frost during their first cold weather.	February, and during rains.	40	Cultivated throughout India.
Ceratonia siliqua, *Carob.*	A slow-growing evergreen tree of small size; leaves once subdivided (pinnate), thick, shining; male and female flowers generally on different trees in tufts springing from the bark of the trunk or branches. The pod contains a nutritious mealy pulp which is much used along the Mediteranean coast as cattle fodder and for human food.	By seed, or by grafting or seedlings; seed should be sown in February.	In nurseries these seedlings require protection from the rains in the first year.	Cold weather ...	30'	It is doubtful whether trees raised from seed in this country will give fruit of the same value as in Sicily or Cyprus. Trees in the Lucknow Horticultural Gardens fruit abundantly, but the pods are apparently dried up by hot winds and are innutritious. The best varieties are propagated by grafting, and arrangements have been made for the importation of the grafted trees to make a trial with. In any case it is advisable to graft buds from a male into a female tree, as this facilitates fertilization.
Prosopis spicigera, *Jand.*	A moderate sized thorny tree; leaves twice subdivided (bipinnate); flowers small, yellow; branches armed with scattered broad conical prickles; pods long, pendulous, contracted between the seeds, like those of the babúl, which the tree much resembles in its habit of growth. The pods contain a mealy pulp which is eaten, either raw or boiled, with vegetables and butter.	By seed, which ripens in June and should be sown in rains	In nurseries, or with probable success *in situ*, following the same method as that prescribed in the case of the Babúl (Acacia arabica.)	Cold weather or rains.	20' to 25'	Common in the dry tracts of the Panjáb and Sindh, and does not thrive in an average rainfall of over 35 or 40". Is better suited for plantation on waste land than for roadside avenues.
Inga dulcis, *Dakhani Babúl.*	A large tree armed with short straight thorns: leaves subdivided, leaflets unequal sided. flowers yellowish white in globose heads: pod twisted ½" broad, containing seeds imbedded in a sweetish pulp, which is eaten.	By seed, which ripens in May and June.	In nurseries ...	Rains ...	35'	Indigenous in Mexico, and introduced into India originally from the Philippine Islands. Commonly cultivated in Madras Makes an admirable hedge plant, as well as a handsome avenue tree.

Name Botanical, English, and Vernacular.	Description of tree and its use.	Mode of propagation and season for procuring seeds or making cuttings.	To be sown in nurseries or *in situ*, and any special instructions necessary.	Seasons for planting out.	Distance at which should be planted out.	Natural habitat and any peculiarities of growth, &c.
Acacia arabica, *Kikar* or *Babúl*	Under favorable circumstances a large tree armed with long, straight, whitish colored spines, the points of which are very sharp and often of a brown colour; Leaves once subdivided (pinnate); flowers yellow in globose heads. The bark and pod are much used in tanning; the leaves make excellent fodder.	By seed, which ripens in April, and should be sown at commencement of rains or by cuttings in February.	In nurseries, or better *in situ*, seed patches 2′ × 2′ × 2 being prepared along the road-side at intervals of 10′, thin out in the 2nd, 3rd, and successive years, eliminating the weakest plants till ultimately in the 7th and 8th year only one tree is left to each patch.	Rains ...	20 ultimately 40 by removal of alternate trees.	Common in Upper India, east and south of the regions of extreme frost, which it is unable to stand. It takes the place of the *Jand* throughout these provinces. Will do well on heavy soil and thrives even on *kankar*.
Terminalia bellerica, *Bahera*.	A large tree with a tall straight trunk and broad massive crown; young branches covered with light, rust-colored down; leaf-stalk longer than ⅓rd of the leaf; flowers yellowish green without petals, with a strong offensive smell; fruit egg-shaped, grey, velvetty, 5-furrowed; a favorite food of deer and cattle and used in dyeing and tanning, being one kind of the myrobolans of commerce. The kernels are eaten by men, but are not considered wholesome.	By seed, which ripens during the cold season and should be sown in April.	In nurseries ...	Ditto ...	40′	Common in the sub-Himalayan forests of these provinces, and succeeds well in Oudh and Rohilkhand.
Terminalia chebula, *Harra*.	A large tree, but rather smaller than the preceding, which it much resembles; young foliage and branchlets covered with long shining hairs; leaf-stalk shorter than ⅓rd of leaf; flowers yellowish white without petals and with a strong offensive smell; fruit egg-shaped, 5-angled. When dried, is the black myrobolan of commerce, much used in tanning and dyeing.	By seed, which ripens in February-March, and should be sown in April.	Ditto ...	Ditto ...	40′	Common in the sub-Himalayan forests and Siwalik tracts.
Terminalia arjuna, *Arjun*.	A tall tree with a close handsome crown, trunk with huge angular buttresses; bark greenish white, peeling off in large thin layers; leaves hard, oblong; flowers in spikes; fruit 1-1½″ long with 5 wings, irregularly marked with ascending crosslines It is uncertain whether its foliage is or is not used for fodder; its bark is in much repute as a tonic.	By seed, which ripens in the cold season, and should be sown in April.	Ditto ...	Ditto ...	40′	Common in dry situations in the forests of Oudh and Central India. Is not indigenous in the Panjáb. Thrives excellently well in tolerably dry localities and on sand. An extremely handsome tree.
Terminalia tomentosa, *Assain*.	A tall tree, trunk not buttressed; leaves hard, oblong; flowers in panicles (loose spikes); fruit winged and the wings marked with lines which are transverse and not ascending. Foliage lopped for cattle-fodder.	By seed, which ripens in the cold season and should be sown in April.	Ditto	Ditto ...	40	Common in the forests of Oudh and Central India, but prefers damper localities and a closer, heavier soil than the preceding tree.
Eugenia jambolana, *Jamun*.	A moderate sized tree, with spreading and ascending branches forming a close shady crown; bark greyish; leaves shining dark green; flowers small, greenish colored; fruits plumshaped, purple or black, much eaten by natives. The tree is nearly evergreen and makes therefore an excellent avenue tree.	By seed, which ripens in the hot weather and must be sown fresh.	In nurseries or *in situ*; four or five seeds being sown and the healthiest seedling kept.	In February or during the rains.	40′	Common throughout Upper India, except in the most arid tracts Does not require a damp soil, but flourishes most in a light loam or sand. It is said to thrive on marshy or low-lying land.

Bassia latifolia, *Mahúa*,	A large tree with milky juice; leaves large, prominently veined, clustered towards the ends of branches; flowers large, greenish white forming an egg-shaped tube with a clayx covered with rust-colored down, sweet-scented; fruit green, fleshy, 1′-2″ long. The flowers are eaten raw or cooked and used in distillation of spirits in some parts of the provinces. The fruit is also largely eaten and the seeds yield good oil.	By seeds which ripens in the hot weather and must be sown fresh.	In nurseries or *in situ*; four or five seeds being sown and the healthiest seedling kept.	Rains ..	40′	Cultivated in most parts of India, and thrives in the damp soil of Gorakhpur and in the drier climate of Bundelkhand. Met with more seldom in Dúáb districts west of Cawnpore.
Mimusops indica (Kauki syn.), *Khirni*.	A large evergreen tree, with hard, shining leaves on stalks ⅛th their length; young foliage not downy; flowers whitish ½″ across; fruit a yellow berry, the size and shape of an olive; is eaten.	By seed: fruit ripens in the hot weather and should be sown fresh.	In nurseries ...	Ditto ...	40′	Indigenous in the forests of South and Central India. Cultivated in these provinces. thrives well in a light sandy soil and forms fine groves. Often planted in old Muhammadan cemeteries.
Mimusops elengis, *Mulsari*.	A large evergreen tree, with hard shining leaves on stalks ⅛th their length; flowers pure white, fragrant nearly 1″ across; fruit a yellow berry 1″ long; is eaten.	By seed; fruit ripens in the hot weather and should be sown fresh.	Ditto ...	Ditto ...	40′	Indigenous in the forests of Ceylon and the Western Ghats; cultivated throughout India.
Diospyros melanoxylon, *Tendu*.	A moderate sized tree with long narrow leaves, smooth above, downy beneath; male and female flowers on different trees; fruit yellow, globose, supported by the calyx lobes, with a soft sweet pulp, which is much eaten.	By seed; fruit ripens in March-April, and should be sown fresh.	Ditto ...	Ditto ...	30′	Common in the dry forests of Bundelkhand, and will probably succeed best in districts south of the Jumna.
Cordia myxa, *Lasora* or *labhera*.	A moderate sized tree, 30-40′, with a short trunk and a rounded crown; foliage dense light green; leaves ovate; flowers small white, in clusters; fruit plumshaped, pink or black, with a viscid sweetish pulp, which is eaten as a vegetable or pickled. The kernel is also eaten.	By seed, which ripens in May-June.	Ditto ...	Ditto ...	40′	Wild in the outer Himalaya and Siwalik forests; cultivated throughout India. A very hardy tree.
Morus alba (with Var. nigra), Mulberry, *Tut*.	A middle sized tree with ovate toothed leaves and male and female flowers in separate spikes, often on different branches; fruit white, red or black, sweet. Leaves used largely for fodder and for raising silkworms.	From seed, which ripens in June and should be sown then, or from cuttings in February.	In nurseries: the seedlings require much water, but are very hardy in transplanting.	Rains, or in cold weather.	30′	Abounds in Afghanistan and in North-West Panjáb (Peshawar). Has been successfully cultivated in the sub-Himalayan districts in these provinces, and is used as an avenue tree in Bulandshahr and elsewhere.
Ficus indica, Banian, *Burgad*.	A large tree with spreading branches sending down numerous slender roots which descend to the ground and afterwards become trunks; leaves thick, ovate, with a broad gland at the top of the leaf-stalk on the under side; fruit downy red, when ripe, is eaten in times of scarcity. Leaves a favorite fodder for elephants and camels.	By cuttings at commencement of rains; seed that will germinate is not easily obtained.	In nurseries ...	Rains ...	50′ to 60′	Wild in the forests of the Himalayan Tarai and in Bengal. Prefers a damp climate and is seldom seen with its aërial roots well developed in the dry climate of these provinces.
Ficus religiosa, *Pípal*.	A large tree with a short buttressed trunk and widely spreading branches; bark greyish; leaves shining, with a long slender leaf-stalk and tapering to a thin point; fruit purple when ripe. Young shoots eaten as a vegetable in times of scarcity. Leaves and shoots are good fodder for cattle.	By cuttings at commencement of rains or by seed. The fruit ripens in the hot weather and should be sown fresh.	Ditto ...	Ditto ...	50′ to 60′	Wild in the forests of the Himalayan Tarai and in Bengal. Though preferring a damp to an arid climate, grows well in the drier districts of these provinces (Agra, &c).

Name : Botanical, English, and Vernacular.	Description of tree and its use.	Mode of propagation and season for procuring seeds or making cuttings.	To be sown in nurseries or *in situ*, and any special instruction necessary.	Season for planting out.	Distance at which should be planted apart.	Natural habitat and any peculiarities of growth, &c.
Ficus infectoria, *Pakhar.*	A large tree with short trunk, the bark on which exfoliates in long strips; young shoots slightly downy; leaves shining, abruptly pointed; fruit white; when ripe, edible. The young shoots eaten as a vegetable, the leaves and twigs used for fodder.	By cuttings at commencement of rains.	In nurseries ...	Rains ...	50' to 60'	Common in the Oudh forests and in Burma. An excellent avenue tree, extremely handsome and very quick growing.
Ficus cordifolia, *Kabar or gajjan.*	A large tree with short trunk much wrinkled and buttressed, with yellowish grey bark exfoliating in hard scales; leaves pointed, but not so much as those of the *Pípal* and more rounded than those of the *Pakhar*: Fruit black when ripe, ½" in diameter; is eaten and the foliage used as fodder.	By seed in hot weather, or by cuttings at commencement of rains.	Ditto ...	...	40'	Wild in the Siwalik and outer Himalaya, but not common. Somewhat resembles the *Pípal* in appearance, but on a smaller scale.
Ficus glomerata. *Gúlar.*	A large tree with greyish brown bark and smooth (not furrowed), trunk leaves lanceolate; under side pale and covered with minute green dots; fruit borne on the trunk and main branches and not on the smaller branchlets, as in the case of the preceding trees, large (1-2" in diameter) orange or red when ripe; is eaten and in times of scarcity made into a kind of bread. Foliage used for fodder.	By seed in hot weather, or by cuttings in the rains. Seed does not germinate easily.	Ditto ...	...	40'	Common in Oudh and the Doáb districts, preferring the banks of rivers or streams.
Artocarpus integrifolia, Jack, *Kathar.*	A large tree with dark green leaves, shining above, rough beneath; branchlets with annular raised lines, the scars of fallen stipules; fruit large, attached to the trunk and branches by short stalks. It is an important article of food, much relished by natives though repugnant to most European tastes.	By seed in May and June.	Ditto ...	...	40 to 50'	Cultivated in Bengal, Central and South India, and in the damper districts of these provinces. Will grow in the dry districts of the Ganges and Jumna Doáb, but does not attain the size it displays in Oudh or Gorakhpur.
Artocarpus lakucha, *Barhal.*	A large tree with leaves shining above and downy beneath; branchlets without annular rings or scars; Fruit large, not so distinctly stalked as in the jack tree; yellow when ripe: an article of food.	Ditto ...	Ditto ..	...	40	Wild in the outer hills of Kumaun and in East Bengal and Burma. Would probably succeed only in the sub-Himalayan districts of these provinces.

ABSTRACT

OF

GENERAL REMARKS ON THE YEAR'S OPERATIONS

AND

PROGRAMME FOR 1880-81.

APPENDIX III.

ABSTRACT OF GENERAL REMARKS ON THE YEAR'S OPERATIONS AND PROGRAMME FOR 1880-81.

District.	General remarks on the operations of the year, on the state of existing avenues, &c..	General programme for 1880-81.
Dehra Dún ...	The existing avenues are in good condition. No trees planted lately.	The sanctioned grant for 1880-81 is Rs. 100 This amount is to be expended for maintenance of the two nurseries. There will be no transplanting for the next two years.
Saháranpur ...	The operations of the year under report consisted in maintaining some young trees on three first class roads, *viz.*:— From Saháranpur to Chattralpur ... ... 14 miles. From Chattralpur to Mohand ... ... last 6 „ From Roorkee to Chattralpur ... ... first 4 „ and in filling some gaps in them. Rs. 449-8-6 have been spent by District Engineer in digging pits to plant in young trees on the Roorkee and Chattralpur road from mile 4 to 14, this part of the road requiring trees throughout. The pits are 4 feet in diameter and 4 feet deep, and have been dug in accordance with the instructions received from the Director of Agriculture and Commerce, *vide* Circular 6 (Arboriculture) of 1879. The maintenance of young trees on the last 8 miles of the Deoband and Rampur road was entrusted to the tahsildar of Deoband. Rs. 136 have been spent by the Tahsildar in the payment of wages of malis and bhishtis on this account. He reports that many of the trees had been destroyed by frost. A small amount of fresh planting has been done in tahsil Nakur, only 3 furlongs in all.	On the Saháranpur-Chattralpur road some trees require maintenance, and probably about 100 may be wanted during the year to fill up gaps. On the Chattralpur-Mohand road trees on the last six miles are young and require maintenance, and on the whole length there will be gaps to be filled up. After the first four miles of the Chattralpur to Roorkee road trees are required throughout. As stated in the preceding column, pits have been dug for the reception of new trees. On Rampur-Deoband road nearly 550 trees require maintenance and some 100 are required to fill up gaps.
Muzaffarnagar ...	The trees planted by District Engineer on miles 33 to 44 of Meerut and Roorkee road and on the 2 miles of Muzaffarnagar and Shamli road during the last three years still require care.	The tahsildar of Muzaffarnagar has been ordered to take care of the new plants on the Meerut and Roorkee road, and if the district grant be increased, a new road will be taken in hand.
Meerut ...	The avenues are in a flourishing state and the trees planted during the year are all thriving.	About 4,050 trees will be planted in the nurseries: nearly 18 miles of first class roads will be under operation as regards planting and maintenance.

Bulandshahr ...	The roads planted during the year were as follows:— ...	During the year 1880-81 the trees on the Bulandshahr-Khurja road will be thinned out. They are all babuls which have been very irregularly planted or rather sown. The number that can be felled with advantage will be considerable, and the amount realized will probably be not less than Rs. 200 It is proposed to continue the avenues on the Debai and Chola railway feeders, and also to plant some trees on the road beside the exhibition ground.
Aligarh	Of all the trees planted during the last three years by the District Engineer few will come to any good, owing partly to want of care in tending them, but more especially to the neglect to prepare the ground to receive the young trees and to operations being too scattered.	It is proposed to confine the operations of the present year— (1) to protecting, as far as possible, the trees which exist and are worth caring for. (2) to planting and filling up gaps on two miles within the first six miles of the Koel and Agra road. Pits are being dug to be filled with good soil ready to receive young trees directly the rains commence. Aligarh is so well provided with canal nurseries that it is unnecessary to do more than keep one small district nursery at the head-quarters in the compound of Public Works Department godowns, which will be cared for by one of the malis and bhishtis employed on the roads immediately adjoining the station.
Bijnor	The state of the existing avenues is fair, except that during the late heavy frosts several young trees succumbed, especially the mango trees, which don't seem to be able to stand the effect of severe atmospheric changes. They were, however, replaced by other trees which seem to be thriving. The sale of trees on the Bijnor-Moradabad and Bijnor-Najíbabad roads, with loppings on all roads, was carried out by the tahsíldar of Bijnor, and the prices realised appear fair. The experimental sowings of *Inga dulcis*, *Prosopis*, *Cyprus funebris*, *Cyprus sempervirens*, *Cyprus torulosa*, have been pretty successful, though they were not on a very extensive scale. *Note.*—The "gharra" system of watering was taken in hand about the middle of April, and the experiment has had only a trial of (say) two months, but already there has been improvement in the plants. There is certainly an advantage in this over the old system of surface watering, as it takes three days for a pot to empty itself, and consequently the plant has sufficient moisture in hot months to sustain life. These pots being again filled on the third day, there is a constant supply of water kept up.	Beyond maintaining the usual establishment for tending roadside avenues, and looking after trees in nurseries, &c., it seems doubtful whether anything else can be done unless additional funds are sanctioned, in which case it is proposed to prepare "thalas" in half of the 8th mile of Bijnor and Moradabad roads for planting new trees in 1881-82.

Bhur-Khurja road	7 miles.
Debai railway feeder	1 mile.
Anúpshahr-Aligarh	3 miles.
Bulandshahr-Sikandrabad	8 „
Chola railway feeder	2 „

Besides these a grove of trees was also planted out at Rajghát sarai. The state of the trees is generally good.

Abstract of general remarks on the year's operations and programme for 1880-81—(continued).

District.	General remarks on the operations of the year, on the state of existing avenues, &c.	General programme for 1880-81.
Moradabad ...	Beyond the maintenance of nurseries and excavating a few pits on the Moradabad and Meerut road for new trees and the forming of a new nursery in Moradabad, nothing further has been done, and it is a pity that a large sum of money was allowed to lapse when it could have been laid out to great advantage in filling up gaps in avenues on 1st class roads. The utility of forming the nursery at Moradabad is questionable, as it is only to contain expensive fruit trees which are not to be planted out, and for which an establishment must be maintained at a yearly cost of Rs. 181.	*New avenues.*—Under this head it is proposed to operate on 2 roads, Moradabad-Meerut, 1st class, and Pakhura-Amroha road, 2nd class. The first half of 7th and half of 8th miles are to receive new trees, and in the second, miles 1 and 2. The trees, principally mangoes, must be taken from the small branch nursery situated close to the railway station, and a small margin has been allowed for carriage. *Planting and maintenance*—It was suggested a trial should be given to the planting and maintenance of roadside avenues by zemindars. Although such a system is not in vogue in this district, if it be introduced much success is possible.
Bareilly ...	The operations of 1879-80 were not very well planned or carried out. Rs 226 were spent in planting out and fencing new trees, and Rs. 550-10-6 in watering and protecting trees planted out.	The chief business of the current year will be to complete the lines of trees upon the miles planted in 1877 and 1879 and to get all the trees in those lines properly fenced and tended. The seedlings in one of the nurseries started by the District Engineer will be planted out in the rains and the nursery given up.
Budaun	The operations of the year consisted in watering portions of the Bareilly-Háthras and Budaun-Farukhabad road. *Thalas* were dug on 3 miles of the Chandausi road, and avenues were maintained on this road. A considerable portion of the year's expenditure was incurred in the maintenance of the two nurseries, one on the Aonla road and the central nursery at Budaun.	As regards nurseries no fresh planting or sowing will be done. The operations under this head will be confined to the maintenance of about 10,796 trees planted and raised in 1879-80. The trees on two roads planted in previous years will be watered, the total length under operations being 8 miles of a 1st class and 3 miles of a 2nd class road. The trees on the Bareilly-Háthras road, nearly 126 in number, will be felled this year.
Sháhjahánpur ...	Five roads were taken in hand, but the operations were chiefly confined to the Rohilkhand trunk road. The trees planted on this road are doing fairly well, but some damage was done by frost in the cold weather.	Miles 43 to 47, 39, 40 and 21 to 29 of the Rohilkhand trunk road to be taken in hand for planting out and 15 miles for maintenance to complete miles 1 and 2 of the Sitapur road and take in hand miles 5 to 8 It has been decided to do nothing more to other roads till the Rohilkhand trunk and Sitapur roads have been completed.

Muttra	A nursery was started during the year in the Muttra Government Garden; the seedlings, if they do well, should be fit for transplantation in 1881-82. Young trees planted out in gaps on Muttra-Díg and Agra-Aligarh roads. Pits dug and filled with leaves on Muttra-Brindraban road There are good avenues in the district on a considerable number of roads, *viz.*:— Muttra-Agra road. Muttra-Delhi road (very good). Muttra-Díg road. The trees on the greater part of this road were planted by private persons, who look after them and take the fruits and dead wood. They were directed to fill up the gaps and they did something, but not in a very satisfactory manner. Muttra-Bharatpur road. Muttra-Sadabad road. Sadabad-Shahpur road. Mat-Raya and from Raya to Buldes. Chatu to Sahar and Chatu to Shergarh The minor roads of the district are either without trees or badly provided with them. The trees planted on the Agra-Aligarh road (mostly shisham) are in a thriving condition. Those planted on the Muttra-Delhi road have nearly all died; the necessary establishment could not be kept for want of funds. The trees on Muttra-Díg road look very healthy.	Maintaining nurseries at Muttra:— Maintenance of trees on Agra-Aligarh road ... 10 miles. Ditto on Muttra-Díg road ... 18 „ Digging pits (600) on Muttra south road ... 2 „ Collecting leaves on ditto. Digging pits (600) on Muttra-Bindraban road ... 2 „ Collecting leaves on ditto. Purchasing (600) trees for Muttra-Bindraban road, for which 600 pits were dug in 1879-80.
Agra	The year's operations were chiefly confined to nursery planting, which may be said to have been fairly successful. The existing avenues on 1st class roads, with the exception of the Gwalior road, are fair. The tree-planting of the year cannot be called a success, for most of the trees have been either destroyed or perished from frost.	It is proposed— (1) to plant 10,200 seedlings; (2) to plant 1,082 trees on the Gwalior road; (3) all the 1st class roads are to be taken in hand in the matter of lopping and felling.
Mainpuri... ...	The general state of the existing avenues is good, and the trees planted lately on roads are properly cared for and looked after.	In the year 1880-81 it is proposed to plant 1,000 trees in the nursery. The expenditure will nearly amount to Rs 56 in rent of land, pay of malis, watering, purchase of seeds. Some 225 trees will be planted in the Kauli-Ghiror road during the year and about 220 on road from kutcherry to city, which is much used by people going to and from kutcherry, and the trees planted by the District Engineer on station roads during 1879-80 will be maintained. The total cost under the head "planting and maintenance" is estimated to be Rs. 279.

Abstract of general remarks on the year's operations and programme for 1880-81—(continued).

District.	General remarks on the operations of the year, on the state of existing avenues, &c.	General programme for 1880-81.
Farukhabad ...	Arboricultural operations were taken in hand rather late in the year,—not till the end of February,—so that the young trees were planted out under disadvantage, but most of them, nevertheless, appear to have survived. The gharra system of watering was adopted with success, and the District Engineer says that in transplanting care was taken to have a good-sized clod of earth surrounding the roots of each tree.	(a) Planting along the Farukhabad-Patya road 2 miles. (b) Ditto the Bewar road ... ... 6 „ (c) Ditto station circular road, scattered 2¼ „ (d) Maintenance of last year's planting on Bewar road, 4 „ (e) Ditto Kaimganj road on this side of the tahsil, 4 „ This programme will involve an expenditure of Rs. 620, to which must be added a debt of Rs. 127-8-0 incurred in the previous year. This brings the total to Rs 747-8-0, whereas the allotment for 1880-81 is only Rs. 574. Application is made for an increased allotment of Rs. 800.
Etáwah	Out of Rs. 500 allotted for expenditure Rs. 424-13-9 was spent, of which Rs. 368-4-0 was disbursed through the District Engineer for the maintenance of trees on the principal roads of the district, and Rs. 56-9-9 went to maintain the Etáwah and Bhartna tahsil nurseries, from which 137 young trees were planted out. The other 3 tahsil nurseries not only supplied no trees but lost more than half of the existing saplings, and in fact virtually ceased to exist. The Etáwah and Bhartna nurseries, though they lost a very large number of trees, have still about 3,700 available for planting.	For the future recommends that trees for the district roads be grown by arrangement with the Canal Department at all the canal bungalows on the Etáwah and Bhognipur branches of the Ganges Canal and planted out when they are four years old. This will secure the benefit of the canal water, the existing experienced canal plantation establishment, and the constant inspection of canal officers.
Etah	All the trees planted look healthy and strong. Gharra style of watering adopted with great success.	About 2 miles of Etah-Marehra road will be taken in hand and 528 trees planted out; also 2 miles of Marehra road, where 528 more trees will be planted. The young trees planted out during 1879-80 on the Government Trunk Road, Etah-Marehra, and Háthras-Kachlaghat roads will be maintained and watered. Seed will be sown in the nurseries at Etah and Goraka, and all available ground; as road chauki compounds, will be utilized as nurseries. Some babul seed will be purchased for sowing on roads passing through usar plains.
Jalaun	The provincial revised budget was not received till July, 1879, and the allotment not till after the rainy season had passed; hence very little progress was made in arboriculture. Arrangements for	The operations for the current year may be summarised as follows:—Maintaining the present avenues; purchasing seed and plants for the nursery at Orai; extending the avenues in the Kálpi and Ingin

	establishing a 1st class nursery at Orai are now complete, and it is hoped that next year's report will show an improved state of affairs.	and Orai and Jalaun roads. Instructions have been issued for the introduction of subsoil irrigation by gharra system, and the result will be communicated at the end of the current year.
Jhánsi	Considering the soil and climate and the drought of 1877 and 1878, the avenues of this district are flourishing. The only portion on which the operations have not been successful is on a portion of the length between Khiriaghat and Moth. The bareness of the country thereabouts renders it especially desirable that maintenance of the avenue be persevered in.	As regards maintenance of existing avenues attention will be devoted to 7 roads,* in all of which there are young trees which still require care and there are gaps to be filled up. The promise of the avenues on those roads is so good that it is considered most unadvisable to discontinue tending them; but as regards planting, the operations of the year will be restricted to a length of only 3 miles on the Mau-Gursarai road. *Viz.—Jhánsi Ságar road ... 24 miles. Station road . 6 „ Ratausa-Budhana road ... ... 12 „ Mau-Orai road ... ... 2½ „ Mau-Ráth road ... ... 2 „ Garotha-Gursarai road ... . 17 „ Baragaon-Garotha ...
Lalitpur	The avenues were made over by Public Works Department in the beginning of 1880 with a sum of Rs. 550-13-6, being the unexpended balance of the grant sanctioned for their maintenance for the past year. This amount has been fully expended, and the avenues which were in a bad state at the time they were made over have greatly improved.	As regards the nurseries no young trees will be fit to plant out on the avenues till the rains of 1882-83, by which time the plants will be three years old. It is therefore proposed to sow more seed in the rains for future planting out. As regards the avenues a grave mistake was made in taking up so many miles of road in 1873-74. Had a few (say 3 or 4 miles) been taken in hand on each road, and so much had been carefully looked after, the avenues would have had a better chance. At the same time, now that these miles of avenues have been planted, they must be kept up. They will be carefully watered and tended where the trees have died off. Deputy Commissioner proposes to prepare the ground for planting fresh trees in 1882-83 by mulching.
Cawnpore... ...	The avenues and the trees newly planted during the year were thriving everywhere.	It is proposed to plant from the nurseries 4,577 trees on the second class roads, *i. e.*, in— Pargana Bhognipur .. ... 1,200 „ Akbarpur ... ... 795 „ Ghátampur ... ... 302 „ Derapur ... ... 2,000 „ Sarh-Sálempur ... . 280 Total .. 4,577

Abstract of general remarks on the year's operations and programme for 1880-81—(continued).

District.	General remarks on the operations of the year, on the state of existing avenues, &c.	General programme for 1880-81.
Fatehpur	During the second half-year no trees were planted anywhere except on Sházipur road. The trees on the Grand trunk road and Dalamau road are still under care of gardeners.	It is proposed to plant 500 trees in the nursery and about 770 on the roads. A new avenue on a 1st class road has been started this year, the total length being 4 miles. The trees on the following roads planted since 1875 will be maintained:— Grand trunk road .. ... 4 miles Dalamau road ... ... 1 „ Bánda road ... ... 6 „ Station roads ... ... (scattered). All 1st class and have about 3,700 trees.
Bánda ...	A number of young trees, it is feared, will not survive until the rains, although effort is being made to have them watered and to protect them from cattle and field rats. It is hoped, however, that at least 8,000 plants will be pulled through, and if this is done the money granted will have been well spent. The Public Works Overseers neglected the trees on the Ságar-Fatehpur roads and allowed a number of them to get destroyed by cattle. Some of them were however replaced, and those that remained have since been carefully looked after.	The general programme for the year 1880-81 will be to complete the planting out on the Fatehpur, Ságar, Manikpur, and Hamírpur roads, and to plant trees on the Kálinjar road as far as Girwan (10 miles from Bánda), as well as to protect the young trees already planted.
Allahabad ...	On the 1st class roads the existing avenues are, taken as a whole, half full; in some places but few trees are wanting, in others there are no trees at all. The young trees planted out during the last few years are getting on well. About 15 per cent. may be taken as the average that have died.	The operations to be undertaken during 1880-81 embrace:— 1. *As regards nurseries.*—The maintenance of the central nursery at Allahabad, where, it is hoped, 6,700 seedlings will be raised and 1,300 planted out. 2. *The planting* out of 4 miles of the Grand trunk road and 4 miles of a second class road. 3. The maintenance of the 50 miles of road planted out in previous years and with those of three small outlying nurseries It is intended to thin the trees on the Fyzabad road, and possibly there may be other thinnings to be done. It is also hoped that some planting may be done by zemindars on 2nd class roads.
Hamírpur ...	The general state of existing avenues is good ...	Only 12 miles are under operations, *viz.*:— 6 miles of the Hamírpur Kabrai road, 1st class. 6 „ of the Bánda-Ságar road, do.

		The deficiency of funds renders it impossible to plant anything. Some pípals may be sown in the nurseries, and a few mahuas, as seedlings are procurable wild at Mahoba. If possible some seeds of tendu, chironji, kabar and pakar will be obtained and sown at head-quarters. Mangoes do not thrive in this district. Attempts will be made to negotiate with zemindars for planting and maintenance.
Jaunpur ...	One-fourth of the trees planted had dried up, but almost all have been replaced. The trees standing are healthy and promising, and it is expected that by proper treatment they will spring up rapidly.	Two thousand eight hundred and five (2,805) trees will be kept up in the nursery, and 450 trees will be raised. The trees on five miles will be maintained, also those on two encamping-grounds.
Azamgarh ...	The operations were on a very small scale, but the number of seedlings in the nursery available for planting out must always be the measure of the planting out operations. The trees planted out have done well, and the "gharra" system of irrigation which has been adopted with them has apparently been most successful	It is proposed to transfer the central nursery to the public gardens, where a small plot will be set apart for the nursery. The present nursery will also be maintained so long as there are any seedlings left in it. As but few seedlings will be available for planting out this year, it is proposed to devote the greater portion of Arboriculture fund in sowing babul on the sides of the Mau 2nd class road. As it is calculated that the cost per mile will be about Rs. 10, it is hoped that the whole length of this road will be taken in hand this year. Efforts will also be made, in concert with the District Engineer, to re-establish small nurseries at the road bungalows on the 1st class road.
Mirzapur ...	The trees on every road planted since 1875 are in a good healthy state.	*As regards nurseries* 525 trees are required for planting out of the Chunar tahsil nursery. *Maintenance* is required on three roads, the Barkucha, Rela, and Kotwa roads, as also on a portion of the Grand trunk road. Special attention will be paid to the Chunar cantonment road, and operations here will consist in— 1. Renewing 21 casualties of last season. 2. Removing mud fences of trees sufficiently grown up. 3. Substituting wooden fences for mud ones round the younger trees. 4. Maintenance of the younger trees. It is hoped that by selecting well-grown trees from the nursery, this year's operations will conclude the expenditure on this road. The Garrison Surgeon has represented the necessity for immediate further plantings of trees to north-west of Garrison Hospital. Fourteen trees will therefore be planted along west side of the road.

Abstract of general remarks on the year's operations and programme for 1880-81—(continued).

District.	General remarks on the operations of the year on the state of existing avenues, &c.	General programme for 1880-81.
Benares ...	The young trees were planted out in July and maintained by the Public Works Department as follows:— Grand trunk road up to end of January, 1880. Azamgarh-Gházipur roads, end of August, 1879. The plants on the Grand trunk road are in fair condition.	Trees will be planted on the Azamgarh-Gházipur and Grand trunk roads, the length under operation including maintenance being 18 miles for the Azamgarh road, 19 miles for the Gházipur road, and 13 miles for the Grand trunk road. The gharra system of subsurface irrigation will be introduced on the Ghazipur road. The trees on some portions of the Azamgarh and Gházipur roads having grown to such an extent as to cause inconvenience to passers-by, and a hindrance to the traffic, these branches will be lopped. The lopping operations will be carried on in the cold season, this being more beneficial to the trees. The three nurseries in the district at Chandauli, Mirzamorad, and at Kaithi will be maintained and the nursing of seedlings in them carried on.
Gorakhpur ...	The operations of roadside plantations of the year extended over 5 miles of a 2nd class road (Gorakhpur to Samour). A grove has also been planted during the year at Ramkala Government encamping-ground, on the Gorakhpur-Padraima road, consisting of 140 jack trees.	Seedlings will be grown in the central nursery at Ramgarh, and a few in each of the minor nurseries. The ground will be further cleared for the mango "graft plantation" at Ramgarh. It will, as far as possible, be stocked by grafts from Lucknow and elsewhere. A pucka well is now being dug in its centre. Mango and jack-fruit planting will be continued along the Gorakhpur-Kassia road. It is proposed this year to try dropping the jack seeds into the holes where they are intended to grow. This, if successful, will save much expense on transplanting, which seems also very injurious to the jack seedlings. Maintenance of the Benares and Basti road avenues will be continued and breaks filled up and tended. The jack planting at Ramkola will be looked after and the camping ground at Shajauwan, which requires more trees, will be partially planted with mangoes.

Basti ...	Basti is on the whole a well-wooded district, and the quality of trees planted out is perhaps more important here than the quantity. Avenues on the 1st class roads are very ragged and full of gaps, and there are places where apparently trees will not grow at all. Second class roads, except Basti-Tánda, are almost entirely destitute of avenues. All these avenues contain a number of trees which bear no fruit and are of little value for beauty or shade, *e. g.* Ním.	The nursery will receive as many fruit trees of choice kinds as the fund can provide for. There are few good trees now in the nursery old enough to be planted out, and those which can be planted out will, it is hoped, be planted out through zemindars at little expense. A plantation of carobs will be formed, most of those procured last year having failed.
Gházipur ...	At the commencement of the year there was no nursery in the district, the Public Works nurseries having been previously closed One was started at Gházipur in September, 1879; 1,514 seedlings have been planted in it. The maintenance of the existing road avenues was the only other arboricultural work in hand. The seedlings in the present nursery have been obtained gratis. They are too young to be planted out during 1880-81.	As stated in the preceding column, the present seedlings in the nursery and those to be put down in the rains are too young to be transplanted during the coming year. The operations will, therefore, be confined to maintenance of avenues, which extend over some 15 miles.
Kumaun ...	Of the great length of road in the district the greater portion is naturally planted with trees. The operations of 1879-80 consisted in planting along the roads leading from Almora. This work has only been commenced during the last two years: consequently the trees are still growing and will require care for some time.	During 1880-81 it is proposed to continue planting along the cart road between Almora and Ránikhet, and replacing any seedlings that may have died on this and the Almora and Naini Tal road, which has been planted for four miles. The stock of seedlings of the stronger and faster growing trees which are good for shade will also be increased.
Garhwál ...	The operations were confined to the nursery at Pauri, and there is a very brisk demand for the fruit trees available for distribution from it. Nearly nine-tenths of the whole length of the roads in this district run through well-wooded tracts, and avenues are scarcely necessary except perhaps close to Pauri.	A nursery will be started at Srinagar, where mangoes, guavas, plantains, and such fruit trees as thrive in hot localities and are much prized by the people will be reared and distributed.
Lucknow ...	There are no avenues at all on 2nd, 3rd, and 4th class roads. The avenues on the 1st class roads are fair in parts, but all want more or less planting afresh.	Preparing three miles of Lucknow-Sitapur road for planting new trees.
Bara Banki ...	Since the charge of Arboriculture operations was transferred to the Civil Department (in November, 1879) 77 trees have been planted out and a large number of thalas dug, and walls round most of these thalas have also been built to protect the trees. All the trees planted out are doing well, but are still under the care of two mális. The existing avenues are in a good state, but there are gaps here and there which will be filled up during the operations of this year.	The operations of 1880-81 will be confined to the Haidargarh road from the 1st to the 5th mile, along which 444 trees will be planted for the present. On the Bahraich road also the same length will be taken in hand. It is intended to plant 80 trees along these five miles in place of old trees which died. The same number of nurseries will be maintained as in 1879.

Abstract of general remarks on the year's operations and programme for 1880-81—(continued).

District.	General remarks on the operations of the year, on the state of existing avenues, &c.	General programme for 1880-81.
Unao	The pucka roads, except half a mile of the Ajgain road, have all been planted one time or other. The trees are of various sizes, but most of them are out of harm's way and in a flourishing condition. The gaps on 3½ miles of the station roads and one mile of 2nd class road were filled up during the year, and are now maintained by four men. There are about 67 miles of 2nd and 12 miles of 3rd class roads fairly planted and the trees out of harm's way. Many of the kucha roads are treeless for miles and need attention.	Trees planted in 1879-80 will be maintained. The babul groves on the 2nd and 3rd class roads will be lopped, but little will be realized by sale of the loppings, as they will mostly consist of thin branches.
Fyzabad	Three roads were taken in hand during the year, *viz.*:— Fyzabad to Allahabad, 1st class. " to Lucknow, " " " to Mau, 2nd " " The total length under operation was 43 miles, but in parts of the roads trees existed previously. Sisam, sirsa, rítha, and ním were planted by Public Works Department contrary to instructions received from the Director. This was pointed out to the tahsíldars, who are in immediate charge of the avenues, and orders were given them to act up to instructions.	During 1880-81 it is proposed to erect 825 thalas and to plant trees as under.— In both nurseries at Bikapur and Naurahi 3,400 trees consisting of mahua, jaman, and mangoes. On road from Fyzabad to Allahabad 600 trees, jaman and mango. On Fyzabad to Lucknow road 575 trees, as above. On Fyzabad to Mau 250 trees, as above.
Gonda	The system of planting through zemindars has worked very well. The cultivators and patídars came forward eagerly to obtain permission to plant, and so complete was the success of the scheme that on examining the state of the trees and thalas, it was found that, far more had been planted than could be paid for out of the year's grant. The taluqdars who planted do not require any payment.	During 1880-81 the system explained in the preceding column is to be continued.
Bahraich	No trees were planted out in any of the roads during the year. Amongst the trees planted in previous years on the Bahraich-Byramghat road about 2,031 have dried up and the number requires	In the rains of 1880 about 8,000 different kinds of trees will be sown in the nurseries of this district. There are 424 plants of different sorts ready in the Bahraich nursery for planting, and it is

	replanting. About two miles of the Kurasar-Paiagpur road were planted by a number of trees about nine years ago; some of them are now dried up and they should be replaced. The standing trees on the roads are in good condition and thriving well.	proposed that they should be planted out in the current year on both sides of the Bhingu and Gonda road to the extent of one mile.
Sitapur	The trees beyond the 7th mile of the Lucknow and the 15th mile of the Sháhjahánpur road, or the limits within which the work was carried out during the year, are in a fair condition, and do not at present require any care or nourishment.	It is proposed for 1880-81 to plant out as many seedlings in the nurseries as are likely to be required to fill in gaps as far as the 13th mile of the Lucknow road and 28th mile of the Sháhjahánpur road.
Hardoi	The district generally is well-wooded and highly cultivated, though it is traversed by numerous sandy stretches, especially in the vicinity of the Gharra, Gumti, and their tributaries. Along many of the roads avenues have been planted and the trees have grown to a good size, but gaps of varying lengths occur even in the best grown avenues where the young trees have died and have not been replaced. The operations of the year under report were confined to 2nd class roads radiating from the station. Trees were planted on these for some distance. A good deal of lopping was executed towards the end of 1879-80 on the roads radiating from the station under the superintendence of the tahsíldar, the branches being taken up by auction for the distillery contractors.	It is not proposed to continue the avenues on the Naktaora and Shahabad roads beyond a few miles from the station. Attention will be devoted to completing and tending the avenues on these roads, and providing the existing trees with thalas, and to planting out the circular junction roads above mentioned. The nursery in the public garden is in its infancy, the original stock having been allowed to run down, so that there are no trees fit to plant out this year. It is proposed to stock the nursery anew with some 1,000 trees, which will be fit to plant out after two years.
Kheri	The operations of the year consisted in tending and watering trees on the roads and in the nurseries. The existing avenues are in a thriving condition. No trees were planted out on any of the roads in the district during the year, but those planted in the nursery at Sudder are in good condition, and would be ready for transplantation in the third year.	The trees planted out on roads in previous years will be tended and watered and the withered ones on the Lakhimpur-Gola road replaced during the rains. The seedlings in the nurseries will be maintained till they are replanted.
Rae Bareli ...	In this district the poorness of a great deal of the soil and the great prevalence of white-ants cause the maintenance of avenues to be somewhat difficult, but from the excellent spirit which prevails among the taluqdars and zemindars it is hoped that success will be achieved in the course now being entered on of getting gaps filled and avenues planted by the owners instead of by Government.	The operations of the current year will be confined to the 28 miles which were prepared for planting in the cold weather of 1879-80. The planting will be done through zemindars, who are loyal and well disposed in this district.

Abstract of general remarks on the year's operations and programme for 1880-81—(concluded).

District.	General remarks on the operations of the year, on the state of existing avenues, &c.	General programme for 1880-81.
Sultanpur ...	The funds admitted of little more than the maintenance of the avenues along the main line of road between Fyzabad and Allahabad. The trees seem to be in a healthy state.	Little can be done but to maintain present arrangements.
Partabgarh ...	The avenues are in a fairly flourishing state, as also the young trees...	Lopping trees in Partabgarh and Rae Bareli road (22 miles), and on Partabgarh and Akbarpur road (15½ miles).

F. N. WRIGHT,

Offg. Director, Dept. of Agriculture and Commerce, N.-W. Provinces and Oudh.

NAINI TAL:
The 29th August, 1880.

ORDERS OF GOVERNMENT

No. 252A. OF 1880.

FROM

THE SECRETARY TO GOVERNMENT,
N.-W. PROVINCES AND OUDH,

TO

THE OFFG. DIR. OF AGRI. AND COMMERCE,
N.-W. PROVINCES AND OUDH.

DATED ALLAHABAD, THE 29TH SEPTEMBER, 1880

SIR,

REVENUE DEPARTMENT

I AM directed to acknowledge the receipt of your letter No. 476A., dated the 30th August, 1880, submitting the report on arboricultural operations in the North Western Provinces and Oudh for the year ending 31st March, 1880, the first separate report on the measures adopted to promote arboriculture in these provinces.

2. You have recapitulated the reasons which led to the transfer of arboricultural operations from the Public Works Department, under which they had previously been, to the Department of Agriculture and Commerce, and also given an outline of the new system on which Mr. Buck proposed to work. This was approved by Government, and arboriculture proper, *i.e.*, the planting of new avenues as distinguished from the maintenance of old, was made over to Mr. Buck for the financial year 1878-79, with a grant of Rs. 17,300 for the 47 districts of the North-Western Provinces and Oudh. During that year, however, little could be done beyond issuing general instructions; it was also found difficult in practice to distinguish between planting and maintenance, and the evils of divided authority being apparent, the whole of the operations were transferred to the Department of Agriculture and Commerce from the beginning of the financial year 1879-80, with a grant of Rs. 35,000.

Instructions for the guidance of district officers were issued in your Circular No. 5, dated 10th July, 1880, and consequently after the close of the year under report.

3. His Honor entirely agrees that, as directed therein, only such trees as produce fruit or cattle fodder, to the exclusion of such as are purely ornamental, should be planted. The circular also lays down clearly simple rules for planting out trees, and watering and protecting them during their early growth, the two most difficult problems to overcome. These, if attended to, will prove extremely useful. The best plan in any district must of course depend on local conditions, but the hints given are of a sound and practical character.

4. The operations for the year itself were briefly as follows:—

There are 23,145 miles of roads in the 47 districts, on 1,430 of which operations were carried on. Plants are supplied from 110 nurseries, besides the four central nurseries at Saháranpur, Cawnpore, Lucknow, and

Gorakhpur. These at the beginning of the year contained 86,276 seedlings, 219,561 were planted during the year, and 31,970 were transplanted on to the roads, leaving 263,162 seedlings in store. The different kinds of trees planted out and in store are given in para. 13 of your report, the mango and jámun being most numerous. Those planted out were put on 497½ miles of road.

A beginning has been made in the formation of groves. In the Jhánsi district it was hoped that they would be laid down on an extensive scale, but no report has been received of the operations there.

5. The endeavour to induce private persons and zemindars to plant trees, and to provide for rearing them, is one which should receive the most cordial support, and every encouragement should be given to those who are willing to come forward and aid in this good work. The success already attained in some districts, as noticed in para. 17 of your report, is most gratifying, and Lála Damodar Dás of Bareilly deserves special commendation. Where district officers take an interest in the work, influential native gentlemen will doubtless co-operate in carrying out measures which many of them are taught by their religion to regard as acts of piety.

6. The total expenditure during the year was Rs. 27,804-11-1: the reason the grant was not fully utilized being that the system has not yet got into full working order. The allotments are regulated according to the requirements of different tracts, the largest expenditure being in the Allahabad division.

7. His Honor is glad to learn that efforts are being made to improve the indigenous kinds of fruit, more especially the mango, and that grafts of the best kinds will be distributed at the low rate of 2 annas each, at which they ought to find an extensive sale.

8. The statement appended to the report shows the general state of arboriculture in each district and the programme of future operations. It is admitted that no great success has yet been achieved, and, indeed, this could not be expected during the first year. But the new system is undoubtedly preferable to the old, and the report shows that the department has set to work in a practical and businesslike way. It would seem necessary to impress upon district officers the desirability of not attempting more than their funds will admit of, or of starting operations on too large a scale. There is no advantage in laying down plants which are almost certain to die from want of proper care and protection, and the aim should be to attempt only as much as can be well done and with a fair prospect of success.

9. You suggest that arboriculture in each district should be placed under the special charge of an Assistant Collector, and this may be done, unless the Collector wishes to retain it in his own hands. It is not undesirable that he should do so, as, if he takes a special interest in the work, he would have more influence with the zemindars.

10. There are few matters of more importance to the general prosperity of the country than the maintenance of a sufficient stock of trees,

and in many parts the want of them is felt to be a positive evil; His Honor therefore will look forward with great interest to future operations, and trusts that they will materially increase the growth of all the most useful kinds. Mr. Reid, Collector of Bareilly; Mr. McConaghey, Collector of Bánda; Mr. Boys, Deputy Commissioner of Gonda, and Mr. Harrington, Deputy Commissioner of Rae Bareli, are especially mentioned as having taken much interest in the work, and it is hoped that all district officers will cordially co-operate with the department in utilising to the utmost the funds at their disposal and promoting the extension of arboriculture by every means in their power.

I have the honor to be,

SIR,

Your most obedient servant,

C. ROBERTSON,

Secy. to Govt., N.-W. P. and Oudh.